Low Carbon Fuel Standard Life Cycle Analysis (LCA) Working Group 1 Meeting

October 4, 2007

California Environmental Protection Agency

Air Resources Board

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Agenda

☞ Introductions

☞ LCA Group Objective

☞ Issues to be considered

☞ Discussion of issues

☞ Stakeholder presentations

☞ Other items to be discussed

☞ Topic of focus for next meeting

☞ Proposed meeting date(s)

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LCFS Schedule

2007	**University of California completes LCFS study with CEC & ARB**
2007-2008	**Conduct LCFS workshops**
Early 2008	**Initiate draft regulatory language**
Fall 2008	**Regulatory package completed**
End of 2008	**LCFS regulation submitted to the Board for consideration**
2009	**Regulation submitted to Office of Administrative Law**
2010-2020	**Implementation**

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Life Cycle Analysis

☞ Objective of Full Life Cycle Analysis

- To ensure that all fuels are compared from a "well-to-wheels" pathway

- Committed to this since January 2007 following Executive Order S-1-07

- Include all stakeholders and participants in the development process

- Learn from prior and current LCAs world-wide consistent with our requirements

- Improve and append analysis every few years

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Life Cycle Analysis Capable Models

☞ GREET (Argonne)

☞ LEM   (Mark Delucchi – UC Davis)

☞ GaBi (PE International)

☞ GHGenius (NRC Canada)

LCA Models Comparison

Models	Description	Limitations
GREET	• Identified emissions from transportation sector for U. S., with limited land use impact factors • Criteria pollutant and GHGs addressed for multiple pathways •Widely used model by various studies • Stochastic simulation available	• Limited land use factors and sustainability not addressed. • National averages and does not allow resource mix • Limited CA specific factors. • No economic/price effects • Impact of toxics not available.
LEM	•More comprehensive data source than GREET with improved accounting for land use, vehicles, etc. • Allows for evaluating impacts of resource mix (such as crude from various sources). • CO_2 equivalency factors are different from IPCC values. Includes HFCs, and CFCs • Climate impacts of CO, NOx, PM, SOx included • Results applied for variety of fuels, time frames, and countries.	• Not available in public domain and hence limited scope as a regulatory tool. • Has model specific global warming potentials and deviates from IPCC values. • No economic/price effects except for some quasi-elastic treatment. • Impact of toxics not available.

LCA Models Comparison

Models	Description	Limitations
GaBi	• Capable of retrieving inputs from various databases. This allows the model to work in different areas of interest (biofuels, construction, etc.) • Scenario analysis available	• Proprietary and cost to license
GHGenius	• Canadianized version of Mark Delucchi's LEM model •GHG and criteria emissions for LD and HD only • More comprehensive criteria emissions than the LEM • Economic assessment of the cost of GHG reductions • Sensitivity tool and Monte Carlo simulation available	• Does not include all types of vehicles (mini-buses, scooters, etc.) • Probably similar limitations as the LEM model

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LCA Model Selection

☞ GREET from Argonne Lab

- Energy Commission used a modified GREET model for their Alternative Fuels Plan

- U. S. EPA is adopting the use of GREET with appropriate modifications for their Renewable Fuels Program and Low Carbon Fuel Standard

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LCA Model Selection

☞ Propose to use GREET with necessary modifications to calculate pathway GHG for regulation rule making process

☞ Recognize issues associated with GREET model:
  – Co-products
  – Land Use
  – Sustainability
  – Uncertainty
  – Default Values
  – Fuel Pathways

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Issues

☞ Co-product credit issues
  – Energy, value or mass based credit used in various studies
  – Need for consistent basis to allocate credit

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Issues

☞ Land Use Issues
  – Inclusion of nitrogen impacts (from fertilizer, manure, crop rotation, residue use, etc.)
  – Agricultural run-off
  – Waste-water treatment
  – Variability and uncertainty in agricultural inputs
  – Land cover change (albedo, evapotranspiration, dust from farming, etc.)
  – Agriculture for food

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Issues

☞ Sustainability Issues
  – Water use for biofuel production
  – Ecosystem impact
  – Forest replacement with agricultural land
  – Others

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Issues

☞ Uncertainty and Sensitivity
  – Input values to models are highly variable depending on source, particularly from agriculture
  – Output impacts are at times highly sensitive to certain inputs
  – Some inputs do not have measurable values at the present time
  – Uncertainty in values particularly when a single resource is an average from various areas

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Issues

☞ Default values and baseline
  – Methodology to define and calculate 'default'
  – What about for non-measurable parameters?
  – Establish baseline year for assessing future benefits

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Issues

) Fuel Pathways to be considered initially
  – RFG and ULSD via different crude and refinery specifics applied to CA
  – Ethanol via various pathways (some such as sugarcane not in GREET and electricity mix in GREET is national average)
  – Biodiesel from various feedstocks and pathways (land use issues not covered in detail in GREET)
  – Renewable diesel (not available in GREET)
  – Electricity from different generation sources
  – Hydrogen from biomass (CA specific biomass not available)
  – Other fuels

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Next Meeting Topic

) Focus for next meeting of WG1

) Work to be accomplished before next meeting

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Next Meeting Date

☞ Next meeting date: early November

☞ Future meetings

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For More Information

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Open for Discussion